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DESIGN AND FABRICATION OF QUADRUPOLE ION MASS SPECTROMETER FOR UPPER ATMOSPHERE

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AIR FORCE GEOPHYSICS LABORATORY
AIR FORCE SYSTEMS COMMAND
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The material contained in this report describes, in a quasi-historical format, the design and fabrication of component parts and assemblies used in an Upper Atmosphere Composition Research Program conducted by the Composition Branch of the Aeronomy Laboratory, for AFGL.

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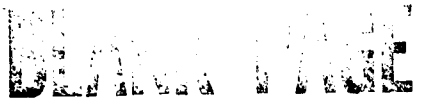

WENTWORTH INSTITUTE OF TECHNOLOGY

YEAR END REPORT NO. 3

CONTRACT NO. F19628-78-C-0017

1 October 1979 - 30 September 1980

INTRODUCTION

Contract No. F19628-78-C-0017 was initiated with the Composition Branch, LKD, of the Aeronomy Division of the Air Force Geophysics Laboratory, Hanscom Air Force Base, Massachusetts, on 1 October 1977. The contract requires that Wentworth Institute of Technology provide the personnel, facilities and materials necessary to design, detail, fabricate, field service, analyze, evaluate and deliver mechanical components and assemblies for aerospace instruments and support equipment.

In order to fulfill this contract the following activities are carried on. Engineering liaison is conducted with Air Force Geophysics Laboratory personnel in order to establish design requirements for instruments and support equipment. Mechanical design, layout and detail of mechanical components to recommend improvements.

DESCRIPTION OF WORK

A design drawing was produced for an electronic housing to replace a cast version. This new design is adjustable to suit each particular application.

On the B.I.M.S. (Balloon Ion Mass Spectrometer) project, detail drawings were made of the following items: electronics housing support plate, base plate connecting the B.I.M.S. to the cryopump, quadrupole housing, oscillator support plate, support legs, insulator shield, rod spacer insulators, mounting plate for the ion multiplier unit, shield plates for support, front orifice cap, grid cap on the multiplier end, quadrupole rods, target insulator and an ion shield.

A layout drawing was generated of the B.I.M.S. in outline showing its dimensions and mounting parameters. An "E" size cross sectional drawing was made to aid engineering design. The unit is similar to the LASSII satelite except for longer quadrupole rods, basic changes in the rod housing, base plate, electronics and ion box areas.

Several drawings were made of items to be tested at AFGL before possible incorporation in B.I.M.S. units. These were of a plexiglass view port, a 10" diameter aluminum collar, a modified 10" O.D. Con-Flat flange, adjusting rods, a fixed outer tube, an adjustable inner tube and a front orifice plate.

A listing of other drawings completed for various projects in this period follows:

PROJECT B.I.M.S.

Mechanical Design

Completed Drawings

(1) Front cover.

(2) Aperture plate.

Completed Drawings

(3) Bracket assembly.

(4) Blow off cap layout.

(5) Pull off arm.

(6) Lever arm.

(7) Hinge bracket.

(8) Tie down plate.

(9) Pivot pin.

(10) Aperture cover.

(11) Squib shield bracket.

(12) Rod spacers.

(13) Target insulator.

(14) Support hanger for the balloon gondola.

(15) Helium and Nitrogen inlet parts cover.

(16) Gondola layouts I and II.

(17) Front orifice port.

PROJECT LASSII

Completed Drawings

(1) Insulator washer.

(2) Angle mount shield plate.

(3) Shield plate.

PROJECT NAMS

Completed Drawings

(1) N.A.M.S. Layout

(2) Ion box.

(3) Grid plate.

(4) Grid cap.

(5) Quadrupole rods.

(6) Insulator.

(7) Rod housing.

(8) Grid cap for the multiplier.

(9) Blow off cap.

(10) Rod spacers (2).

(11) Base plate.

(12) Filament support.

(13) Front cover housing.

(14) Housing.

(15) R.F. shield for the photomultiplier.

(16) Insulators and stand off.

(17) Retaining clip.

PROJECT PLACES

Completed Drawings

(1) Front orifice plate.

(2) Grid ring.

The following items were produced for various projects by the W.I.T. Instrumentation Section.

PROJECT C.I.M.S.

Quantity	Description
3	Top flanges modified for multiplier housings.
6	Feed thru retainers modified for feed thru mounts.

6	Blank gauge flanges.
1	Electronics cover can.

B.I.M.S.

Quantity	Description
10	10" diameter Con-flat flange to fit 6" O.D. tube for a vacuum chamber.
3 each	Side, back, top and bottom plates for electronic housing.

Three housings were assembled from these parts for the electronic mass spectrometer. One of these housings was delivered to the Electronics Department at Northeastern University. After installation of some electrical equipment, Wentworth and Northeastern personnel held a consultation. As a result modifications were made on all three housings.

Quantity	Description
1	10" diameter plexiglass disc.
1	10" diameter collar for a vacuum chamber.
2	Shield supports.
3	Shield plate holders.
4 each	Upper and lower quadrupole rods.
2	Mounting brackets.
1	Tie down plate.
4	Shield brackets.
1	Hinge bracket.
1	Lever arm.
2	Pivot arms.
1	Aperture cap.

Quantity	Description
1	Coupling between adjusting rod and motor for vacuum chamber test unit.
1	Motor mount bracket for the vacuum chamber.
6	Hubs bored out and bronze bushings pushed into three inch pulleys.
4	Inside diameters of Marmon clamps were reduced.
2	Couplings for a Dewar.
1	Helium and Nitrogen fill ports for a Dewar.
1	Bottom plate and adaptor connector for electronics housing.
1	Aperture plate.
2	Shield supports.

Project NAMS

Machine Shop

Quantity	Description
3	Filament supports.
2	Grid caps for the ion box. A milling and turning fixture was made to machine the grid caps.
12	Quadrupole rods.
1	Radio frequency shield for the photomultiplier housing. A second shield was made due to dimensional changes requested after completion of the first shield. A milling and turning fixture was made to machine the shields.
3	Modified Marmon clamps.

Project Places

Quantity	Description
3	Grid plates for rod housings.

Quantity	Description
4	Front orifice plates.
9	Grid rings.

CONCLUSION

In this report no attempt has been made to detail the technical aspects of the varied processes followed in the Design Section or Instrument Shop. The pertinent information was evaluated and used by the AFGL at the time of its generation. The design effort was directed by Mr. Edgar LeBlanc and the Instrument Shop output was directed by Mr. Otto Molter.

During the year purchases of equipment and supplies were requisitioned as needed. The only travel involved was that associated with trips to the Composition Branch, LKD, in Bedford, Massachusetts for the purpose of establishing design requirements as mentioned in this report.


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